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REMARKS

In the foregoing claim amendments, claims 1, 4, 15, 16, 19 and 30 have been amended. Now pending in the application are claims 1-30, of which claims 1, 4, 15, 16, 19 and 30 are independent. No new matter has been added. The following comments address all stated grounds for rejection, and Applicant respectfully submits that the presently pending claims, as identified above, are now in a condition of allowance.

I.   Summary of Claim Rejections

Claims 4-10, 15, 19-25 and 30 stand rejected under 35 U.S.C. 102(e) as being anticipated by Houldsworth (U.S. Patent No. 6,502,110).

Claims 1-3, 11-14, 16-18 and 26-29 stand rejected under 35 U.S.C. 103(a) as being rendered obvious by Houldsworth (U.S. Patent No. 6,502,110) in view of the disclosure in the background section of Houldsworth ("Wilson").

These rejections will be discussed separately below.

II.   Claim Amendments

Claims 1, 4, 15, 16, 19 and 30 have been amended to add language defining "cyclic path." Support for these amendments is found at page 7, lines 25-29 of the specification of the present application. No new matter has been added by these amendments.

III.   Claim Rejections under 35 U.S.C. §102

Claims 4-10, 15, 19-25 and 30 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,502,110 (Houldsworth). Applicant respectfully traverses the rejection for the reasons set forth below.

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A. Claims 4 and 19

Applicant respectfully submits that Houldsworth fails to disclose each and every element of claims 4 and 19. Specifically, Applicant submits that Houldsworth does not disclose at least the following three features: "determining a second value indicative of a number of references to said candidate object from other objects," "determining a third value indicative of a number of cyclic paths including said candidate object" and "controlling disposition of said candidate object on the basis of a predetermined relationship between said second value and said third value," as recited by both claims 4 and 19. These claim features will be discussed in sequence below.

1. "determining a second value indicative of a number of references to said candidate object from other objects"

Houldsworth is generally directed to a method of reclaiming memory space allocated to data structures comprising data objects linked by identifying pointers, in which the memory allocated to data objects is reclaimed using two systems: a first system, by which the data structure is traversed to identify those objects to which no references are made by the pointers of other objects, and reclaiming the memory allocated to those objects to which no references are made; and a second system, which determines which objects are not descendants of root objects and reclaiming the memory allocated to those objects, wherein cycles of the first system are interleaved with cycles of the second system. (See column 2, lines 27-39).

As mentioned above, Houldsworth fails to disclose the feature of "determining a second value indicative of a number of references to said candidate object from other objects," as recited in claims 4 and 19. The Examiner points to the following language (see office action, page 3) at column 6, lines 23-40 as disclosing this feature:

> In order to improve the efficiency of the method of the present invention when processing long lists of linked data objects, the direction of the sweep cycles through the heap could be alternated. Two further reference bits '<' and '>' would be maintained for each data object. The bits represent a reference count of references from each direction in the heap. The '<' bit is marked on a sweep up the heap and the '> is marked on the sweep down the heap that subsequently follows. An object may be safely reclaimed immediately if both '<' and '>' are not set. This is because when an object is reached by the sweep, references from

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that direction must have been checked. The count from the other direction was obtained on the previous sweep, and likewise for any references from that side of the heap. Therefore there can be no other references and the object can be reclaimed. In the worst case, a list where elements are totally interleaved would still be reclaimed in half as many cycles as a unidirectional sweep.

Applicant respectfully submits that Houldsworth fails to disclose "determining a second value indicative of a number of references to said candidate object from other objects," as recited by claims 4 and 19, for the following reasons. First, Houldsworth discloses maintaining two reference bits '<' and '>' for each data object. In contrast, claims 4 and 19 recite maintaining a numerical value for the candidate object. Bits '<' and '>' are not numerical values and, therefore, cannot convey a value indicative of a number of references to said candidate object from other objects as required by claims 4 and 19. The '<' and '>' bits in Houldsworth do not represent the number of references to the object from other objects. Second, the reference count represented by the '<' and '>' bits in Houldsworth is not an actual count of the number of references. When checking that an object can be safely reclaimed, Houldsworth determines if both '<' and '>' are not set, as disclosed in the foregoing Houldsworth excerpt. The specific reference to "bits" indicates that only binary values may be stored there, not a numeric value. Houldsworth does not anticipate representing the reference count by a numerical value. Thus, Applicant contends that the nature of the '<' and '>' bits and their specific technique of use in the Houldsworth implementation makes it clear that the reference bits '<' and '>' are markedly different from "a value indicative of a number of references," as recited by claims 4 and 19.

2. "determining a third value indicative of a number of cyclic paths including a candidate object"

Applicant respectfully submits that Houldsworth fails to disclose "determining a third value indicative of a number of *cyclic paths* including a candidate object," as recited by claims 4 and 19. The Examiner points to the following language (see office action, pages 2-3) at column 2, lines 52-61 as articulating this feature:

> The interleaving of first and second systems may be performed according to predetermined criteria including: cycles of the first system may be performed until no unreferenced objects are found, followed by a cycle of the second system; a cycle of the first system may be interleaved between cycles of the second system; a first number of cycles of the first system are interleaved

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between a second number of cycles of the second system. A global indicator may dictate from which system the next memory reclamation cycle will be derived.

Applicant respectfully disagrees with the Examiner and submits that Houldsworth does not disclose "determining a third value indicative of a number of cyclic paths including a candidate object," as recited by claims 4 and 19. To further clarify what is meant by "cyclic paths," Applicant has amended claims 4 and 19. In response to the Examiner's suggestion on page 9 of the present office action, claims 4 and 19 have been amended to note that the term "cyclic path" refers to: "a strongly connected component such that no node within the strongly connected component has an external reference and no node within the strongly connected component is connected, either directly or indirectly, to an object having an external reference," as stated at page 7, lines 25-29 of the present application. There is no mention of the term "cyclic path" in Houldsworth. It should be mentioned that although memory traversal may occur on objects arranged in a cyclical structure in Houldworth, no disclosure is provided on determining a third value "indicative of a number of cyclic paths including said candidate object," as recited by amended claims 4 and 19.

3. "controlling disposition of said candidate object on the basis of a predetermined relationship between said second value and said third value"

Applicant submits that Houldsworth fails to disclose "controlling disposition of said candidate object on the basis of a *predetermined relationship* between said second value and said third value," as recited by claims 4 and 19 for at least the following reasons. First, Houldworth does not disclose a third value as has been discussed above. Second, Houldsworth does not disclose a second value as has been discussed above. Third, Houldsworth does not disclose "a predetermined relationship between said second value and said third value." Houldsworth states at column 6, lines 41-44 that "whilst the in above description reference counting is performed during the reference-sweep cycle, the reference counting could alternatively, or in addition, be performed during the mark-sweep cycle. This would mean in the above example that objects 540 and 530a are reclaimed one cycle earlier." Houldsworth discloses the aforementioned process of marking references during the reference-sweep and mark-sweep cycles. However, regardless of the cycle during which the above process is carried out, control of disposition of a

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candidate object involves examining reference marks and does not utilize a *predetermined relationship* involving the number of references.

In view of the above arguments and the amendments to claims 4 and 19, Applicant respectfully requests withdrawal of the rejection of claims 4 and 19.

B.   Claims 5-10 and 20-25

Claims 5-10 depend on base claim 4 and, as such, incorporate all of the features of claim 4. Accordingly, claims 5-10 are novel for the reasons set forth above with respect to claim 4. Applicant respectfully requests withdrawal of the rejection of claims 5-10.

Claims 20-25 depend on base claim 19 and, as such, incorporate all of the features of claim 19. Accordingly claims 20-25 are novel for the reasons set forth above with respect to claim 19. Applicant respectfully requests withdrawal of the rejection of claims 20-25.

C.   Claims 15 and 30

Applicant respectfully submits that Houldsworth fails to disclose "detecting deletion of a reference to a candidate object," as recited by claims 15 and 30. The Examiner points to the following language (see office action, page 2) in the abstract of Houldsworth as disclosing the above feature recited by claims 15 and 30:

> A method and apparatus for reclaiming memory space allocated to data structures comprising data objects linked by identifying pointers.

Applicant respectfully disagrees that the above-quoted language anticipates the feature of "detecting deletion of a reference to a candidate object." The Houldsworth abstract states:

> A method and apparatus for reclaiming memory space allocated to data structures comprising data objects linked by identifying pointers. The memory allocated to data objects is reclaimed using two systems. In the first system, the data structures are traversed to identify those objects to which no references are made by the pointers of other objects, and the memory allocated to those objects to which no references are made is reclaimed. In the second system, objects which are not descendants of root objects are determined and the memory allocated to those objects is reclaimed.

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In contrast, claims 15 and 20 recite *detecting deletion* of a reference to a candidate object prior to making a decision on disposition of said candidate object. The pending application at page 7, lines 9-19 specifies the technique in the following way: "The designation process 14 monitors references to the objects in the environment 10 to determine whether particular objects are still necessary.... There are many ways that the designation process 14 may be informed about the deletion of a (external or internal) reference." The pending application further outlines specific ways to detect reference deletions to this end at page 7, lines 9-19. The Houldsworth reference relates to the reclamation of memory *following* disposition of a candidate object, not the technique of detecting deletion of a reference *prior* to disposition of a candidate object, as recited by claims 15 and 30.

In view of the above arguments and the amendments to claims 15 and 30, Applicant respectfully requests withdrawal of the rejection of claims 15 and 30.

IV. Claim Rejections under 35 U.S.C. §103

Claims 1-3, 11-14, 16-18, and 26-29 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,502,110 (Houldsworth) in view of the disclosure in the background section of Houldsworth (hereafter Wilson). Applicant respectfully traverses the rejection.

A. Claims 1, 4, 16 and 19

Applicant respectfully submits that Wilson and Houldsworth do not teach or suggest "determining a third value indicative of the *number of cyclic paths* including said candidate object," as recited by claims 1, 4, 16 and 19. To further clarify what is meant by "cyclic paths," Applicant has amended claims 1, 4, 16 and 19. In response to the Examiner's suggestion on page 9 of the present office action, claims 1, 4, 16 and 19 have been amended to note that the term "cyclic path" refers to: "a strongly connected component such that no node within the strongly connected component has an external reference and no node within the strongly

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connected component is connected, either directly or indirectly, to an object having an external reference," as stated at page 7, lines 25-29 of the present application.

There is no mention of the term "cyclic path" in Houldsworth. Wilson or Houldsworth do not teach or suggest "cyclic paths" as defined by amended claims 1, 4, 16 and 19. In light of the claim amendments, Applicant submits that Wilson and Houldsworth, alone or in any reasonable combination, fail to teach or suggest "determining a third value indicative of the number of cyclic paths including said candidate object," as required by claims 1, 4, 16 and 19.

In view of the above arguments and the amendments to claims 1, 4, 16 and 19, Applicant respectfully requests withdrawal of the rejection of claims 1, 4, 16 and 19.

B.   Claims 2-3 and 11-14, 16-18 and 26-29
Claims 2-3 and 14 depend on base claim 1 and, as such, incorporate all of the features of claim 1. Accordingly, claims 2-3 and 14 are novel for the reasons set forth above with respect to claim 1. Applicant respectfully requests withdrawal of the rejection of claims 2-3 and 14.

Claims 11-14 depend on base claim 4 and, as such, incorporate all of the features of claim 4. Accordingly claims 11-14 are novel for the reasons set forth above with respect to claim 4. Applicant respectfully requests withdrawal of the rejection of claims 11-14.

Claims 17-18 and 29 depend on base claim 16 and, as such, incorporate all of the features of claim 16. Accordingly, claims 17-18 and 29 are novel for the reasons set forth above with respect to claim 16. Applicant respectfully requests withdrawal of the rejection of claims 17-18 and 29.

Claims 26-28 depend on base claim 19 and, as such, incorporate all of the features of claim 19. Accordingly claims 26-28 are novel for the reasons set forth above with respect to claim 19. Applicant respectfully requests withdrawal of the rejection of claims 26-28.

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CONCLUSION

In light of the aforementioned arguments, Applicant submits that Houldsworth fails to disclose, teach or suggest the patentable features of the invention, and contends that the claimed invention is novel and non-obvious in view of Houldsworth.

Please charge any shortage or credit any overpayment of fees to our Deposit Account No. 12-0080, under Order No. MWS-083. In the event that a petition for an extension of time is required to be submitted herewith, and the requisite petition does not accompany this response, the undersigned hereby petitions under 37 C.F.R. §1.136(a) for an extension of time for as many months as are required to render this submission timely. Any fee due is authorized to be charged to the aforementioned Deposit Account.

In view of the above comments, Applicant believes that the pending application is in condition for allowance and urges the Examiner to pass the claims to allowance. Should the Examiner feel that a teleconference would expedite the prosecution of this application, the Examiner is urged to contact the Applicant's attorney at (617) 227-7400.

Dated: November 13, 2006   Respectfully submitted,

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